REPORT DOCUMENTATION PAGE	Form Approved OMB NO. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)
05-12-2011	Abstract	-

4. TITLE AND SUBTITLE	
Learning-Dependent Changes in Brain Responses While Learning to Break Camouflage: A Human fMRI Study	5a. CONTRACT NUMBER W911NF-11-1-0105
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER 611102
6. AUTHORS Nicole Streeb, Xin Chen, Jay Hegdé	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES AND ADDRESSES	8. PERFORMING ORGANIZATION REPORT NUMBER
Medical College of Georgia Research Institute, Ir Georgia Health Sciences University Research Institute, Inc. 1120 15th Street Augusta, GA 30912 -4810	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Office P.O. Box 12211 Research Triangle Park, NC 27709-2211	10. SPONSOR/MONITOR'S ACRONYM(S) ARO 11. SPONSOR/MONITOR'S REPORT NUMBER(S) 57983-LS.3

12. DISTRIBUTION AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

The views, opinions and/or findings contained in this report are those of the author(s) and should not contrued as an official Department of the Army position, policy or decision, unless so designated by other documentation.

14. ABSTRACT

Camouflage represents an extreme case of figure-ground segregation whereby a target object is effectively disguised against its background even when in ‘plain view’. While it is possible to learn to break camouflage with training, the mechanisms that underlie this camouflage learning remain poorly understood.

We carried out an in-scanner learning experiment, in which subjects learned to break the camouflage of up to three different target objects (counter-rotated across subjects) in randomly interleaved trials. We created

15. SUBJECT TERMS

camouflage, learning, fMRI

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	15. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Jay Hegde
UU	UU	UU	UU		19b. TELEPHONE NUMBER 706-721-5129

Report Title

Learning-Dependent Changes in Brain Responses While Learning to Break Camouflage: A Human fMRI Study

ABSTRACT

Camouflage represents an extreme case of figure-ground segregation whereby a target object is effectively disguised against its background even when in ‘plain view’. While it is possible to learn to break camouflage with training, the mechanisms that underlie this camouflage learning remain poorly understood.

We carried out an in-scanner learning experiment, in which subjects learned to break the camouflage of up to three different target objects (counter-rotated across subjects) in randomly interleaved trials. We created camouflaged scenes each of which contained a single novel foreground ‘digital embryo’ target camouflaged against a background of additional novel digital embryos (Hegdé et al, JOV 6:677, 2006). Subjects performed a bootstrapped learning task in which they reported, with feedback, whether or not a given camouflaged scene contained a target.

In early phases of the scan, subjects performed at chance levels (binomial proportions test, $p < 0.05$), indicating that the targets were effectively camouflaged. As expected, each subject (N=3) achieved significant learning ($p < 0.05$) for at least one target object (’learned target’), and failed to learn at least one other object (‘non-learned target’). We found three different regions in either hemisphere in which the responses increased significantly across the scans for learned targets ($p < 0.05$, corrected for multiple comparisons), but not for non-learned targets ($p > 0.05$). In the intra-occipital gyrus (IOG), responses showed a larger decrease below baseline levels for the non-learned target than for the learned target throughout the scan. By contrast, responses in the superior temporal sulcus (STS) and the lateral occipital complex (LOC) increased from baseline levels during learning for learned targets, but not for non-learned targets. Together, these results indicate that camouflage learning results in systematic changes in the responses of these three regions, each previously known to play a major role in object recognition.

Learning-Dependent Changes in Brain Responses While Learning to Break Camouflage: A Human fMRI Study

Nicole Streeb[1,2,4], Xin Chen[1,2], and Jay Hegdé[1,2,3]

[1]Brain and Behavior Discovery Institute, [2]Vision Discovery Institute, and [3]Department of Ophthalmology, Georgia Health Sciences University, Augusta, GA, and [4]Department of Psychology, University of South Carolina, Aiken, SC.

Camouflage represents an extreme case of figure-ground segregation whereby a target object is effectively disguised against its background even when in ‘plain view’. While it is possible to learn to break camouflage with training, the mechanisms that underlie this camouflage learning remain poorly understood.

We carried out an in-scanner learning experiment, in which subjects learned to break the camouflage of up to three different target objects (counter-rotated across subjects) in randomly interleaved trials. We created camouflaged scenes each of which contained a single novel foreground ‘digital embryo’ target camouflaged against a background of additional novel digital embryos (Hegdé et al, JOV 6:677, 2006). Subjects performed a bootstrapped learning task in which they reported, with feedback, whether or not a given camouflaged scene contained a target.

In early phases of the scan, subjects performed at chance levels (binomial proportions test, $p < 0.05$), indicating that the targets were effectively camouflaged. As expected, each subject (N=3) achieved significant learning ($p < 0.05$) for at least one target object (’learned target’), and failed to learn at least one other object (‘non-learned target’). We found three different regions in either hemisphere in which the responses increased significantly across the scans for learned targets ($p < 0.05$, corrected for multiple comparisons), but not for non-learned targets ($p > 0.05$). In the intra-occipital gyrus (IOG), responses showed a larger decrease below baseline levels for the non-learned target than for the learned target throughout the scan. By contrast, responses in the superior temporal sulcus (STS) and the lateral occipital complex (LOC) increased from baseline levels during learning for learned targets, but not for non-learned targets. Together, these results indicate that camouflage learning results in systematic changes in the responses of these three regions, each previously known to play a major role in object recognition.

This study was supported by the U.S. Army Research Laboratory and the U. S. Army Research Office grant W911NF-11-1-0105 to Jay Hegdé. Nicole Streeb was supported by the Undergraduate Research Apprenticeship Program (URAP) of the U.S. Army.